REMARKS

Claims 1-23 are all the claims pending in the application. Claims 1, 5 and 7-22 stand rejected. Claims 2-4, 16 and 23 are withdrawn from consideration. Claim 1 is amended. New claims 24-27 are added.

Claim 1 is amended by incorporating the feature of "the glass does not comprise Li_2O". Support for this feature is provides on page 12, lines 3 and 4 of the original specification (paragraph [0049] of the original specification as published on September 28, 2006 as U.S. 20060216552):

> *"Li2O may be incorporated into glass I in addition to the above components. Li2O has the effect of increasing thermal expansion and raising the Young's modulus, but the proportion precipitating out onto the glass surface is high, and the addition of even a small quantity greatly lowers the glass transition temperature. Accordingly, the quantity incorporated is desirably kept to 3 % or less, preferably 1 % or less.* ***More preferably, none is introduced.*** *When Li2O is introduced, chemical reinforcement can be conducted by immersion in a molten salt containing potassium ions. Through the exchange of Li ions and Na ions, greater mechanical strength can be achieved. Thus, immersion in a molten salt containing sodium ions and potassium ions (for example, a mixed molten salt of sodium nitrate and potassium nitrate) is desirably employed for chemical reinforcement."*

Claim 24

Support for the subject matter of claim 24 is found at pages 8-10 of the original specification (paragraphs [0036], [0038] and [0041] of the original specification as published). The identified paragraphs also teach that all of BaO, CaO and MgO have an effect of increasing Young's modulus, and it is known in the art that BaO has less effect on Young's modulus than CaO and MgO.

Claims 25 and 26

Support for the subject matter of claims 25 and 26 may be found at page 9, lines 12-26 (paragraph [0040] of the original specification as published) , as explained subsequently.

Claim 27

Support for claim 27 may be found at page 7, last paragraph, of the original specification (paragraph [0033] of the original specification as published).

Election/Restriction – Request for Rejoinder

The Examiner acknowledged Applicant's election without traverse of Group II claims 5-15 and 17-22, in the reply filed on 12/19/08.

The Examiner advises that claim 1 serves as a linking claim for the elected inventions of claims 5, 6, 8-15 and 22, and has examined them in the outstanding Office Action.

The Examiner has issued a restriction in the present application and Applicants have complied by electing a group of claims that excludes claim 2. Accordingly, claim 2 has been withdrawn from the consideration by the Examiner.

However, the text of claim 2 defines a supplemental feature of the glass of claim 1, and Applicants believe there is no additional burden for the Examiner, even if the Examiner now examines claim 2 pending in this application. Accordingly, Applicants respectfully request the Examiner rejoin claim 2 in this application.

Further, Applicants respectfully submit that, should claim 1 be found allowable, dependent claims 3, 4, 16 and 23 also should be allowed.

Claim Rejections - 35 U.S.C. §103

Claims 1, 5, 11-14, 19-21 are rejected under 35 U.S.C. §103(a) as being unpatentable over Hashimoto et al (US 6332338) taken with either Hayashi et al (US 5900296) or Koch et al (US 5938812). This rejection is traversed for at least the following reasons.

As a preliminary matter, Applicants respectfully submit that the preparation of glass compositions by the combination of SiO_2 with a multitude of other components, including various metals, rare earth alkaline compounds, and the like, is a science that often does not precisely follow rules and does not involve the simple substitution of materials that generally

have similar constructions or effects. One material may have a straight forward singular effect on a desired property while another similarly structured material may have complex results that lead to undesirable results. The process is not simple cookbook substitutions, but requires extensive an non-routine experimentation, adjustments and exclusions of the amounts of materials used in order to achieve a desired glass with appropriate performance parameters. In short, the process requires innovation by skilled scientists in a manner that is not often predictable, even by others skilled in the art.

The Examiner is respectfully requested to consider this process of invention as conducted in real time, and not in the light of hindsight provided by comparing diverse teachings of various prior art references. In particular, the Examiner is requested to consider the novel and unobvious contribution of the present inventors, as reflected in the currently pending claims based on the discussion that follows.

Claim 1

Claim 1 has been amended to specifically exclude the addition of Li_2O. Support for the exclusion has been provided above. This limitation clearly distinguishes over the teachings of the prior art, as Applicants have demonstrated below that the prior art requires the use of L_2O and does not suggest the combination of claimed glass ingredients that excludes Li_2O.

Hashimoto

The patent to Hashimoto et al is assigned to the assignee of the present application and represents early work by the Applicants on thermally stable glass substrates that include alkaline oxides and alkaline earth oxides.

L_2O Required in Hashimoto Embodiments

Hashimoto teaches that the preferred glass comprises Li_2O, as is clear from the following general descriptions and the content of ALL glass examples 1 to 94. The relevant descriptions in Hashimoto with regard to Li_2O are as follows:

- Examples 1-94, as presented in Tables 1-8 and 10-12 all have a requirement for Li_2O.
- Col. 9, lines 18-25:

"When the chemical strengthening treatment (according to a low-temperature ion-exchange method) is carried out, the glass before the chemical strengthening preferably contains, as glass components, at least 40 mol % of total of SiO.sub.2 and Al.sub.2 O.sub.3, 1 to 20 mol %, preferably 3 to 10 mol %, of Li.sub.2 O, 1 to 20 mol % of Na.sub.2 0, preferably 5 to 22 mol % of total of the Li.sub.2 O and the Na.sub.2 O, and 5 to 30 mol % of total of MgO and CaO."

- Col. 9, lines 33-40:

"Li.sub.2 O and Na.sub.2 O are components for introducing into the glass Li.sup. + ion and Na.sup. + ion which are necessary for the chemical strengthening, and it is preferred to incorporate 3 to 10 mol % ofLi.sub.2 0 and at least 5 mol % of total of Na.sub.2 0 and the Li. sub. 2 O for forming a sufficient compression stress layer. Further, the total content of Na.sub.2 O and Li.sub.2 O is preferably 22 mol % or less for inhibiting the diffusion of an alkali ion."

- Claim 1:

Consistent with the foregoing disclosure in the specification, the claim defines the invention as requiring Li_2O as follows:

"A process for the production of a glass substrate having the form of a disc for an information recording medium by press shaping with a mold having at least an upper mold member and a lower mold member, which process comprises preparing glass materials to obtain a glass which contains 0.1 to 30 mol % of TiO.sub.2, 1 to 45 mol % of CaO, 5 to 40 mol % of total of MgO and the above CaO, 3 to 30 mol % of total of Na.sub.2 O and Li.sub.2 O, 0 to 15 mol % ofAl.sub.2 O.sub.3 and 35 to 65 mol % of SiO. sub.2 and has properties of a liquidus temperature of 1,360. degree. C. or lower and a viscosity of at least 10 poise in a shaping-allowable temperature range, melting said glass materials to obtain a molten glass while temperature-controlling the molten glass to prevent devitrification, then feeding the molten glass through a feed port into said mold and directly press-shaping the molten glass with the mold. "

Comparative Examples

Hashimoto teaches one comparative example glass that has Li_2O (example 4 in Table 9) and four comparative example glasses that have no Li_2O (see Comp. Ex. 1, 3, 4 and 5 in Table 9). While there is no Li_2O, the compositions of these glasses are significantly different from the composition of the glass of claim 1 of the present application in the following respects:

- Comp. Ex. 1: amount of Na_2O is over, Na_2O+K_2O over and BaO less than the claimed amount;
- Comp. Ex. 3: CaO is less than, CaO/total of alkaline earth oxides less than, ZrO_2 less than the claimed amount;
- Comp. Ex. 4: $SiO_2+A1_2O_3$ is less than, CaO over, BaO less than, ZrO_2 less than the claimed amount;
- Comp. Ex. 5: SiO_2 is over, $A1_2O_3$ over, Na_2O+K_2O over, BaO less than, ZrO_2 less than the claimed amount.

Goal of Hashimoto Requires L_2O

Applicants respectfully submit that those skilled in the art, who understand the complex effect that various components at various amounts in a glass composition have on glass performance, would have no motivation to infer from any part of Hashimoto the invention of claim 1, specifically, the combination of components where the glass is not comprising Li_2O. From an objective reading of Hashimoto and a consideration of its goals, it is clear that that all of the glasses of Hashimoto require Li_2O and Na_20 for forming a sufficient compression stress layer.

In addition, Comp. Ex. 1, 3, 4 and 5 also fail to teach or suggest the glass of amended claim 1 since they have other differences in composition from the glass of amended claim 1.

Achievement of Tg in Present Invention Requires Absence of Li_2O

In general, content of an alkaline metal oxide(s) is required for forming a compression stress layer by ion exchange. In Hashimoto, formation of a compression stress layer is made by ion exchange of Li+ and Na+ with Na+ and K+ with a molten salt containing sodium nitrate and potassium nitrate (see col. 13, lines 3-9). However, the glass of amended claim 1 is chemically reinforced by ion exchange of Na+ with K+ with a molten salt of potassium nitrate (see claim 11

and page 25, 17-19). As seen in the specification of this application, use of both Li_2O and Na_2O is preferred from the view of chemical reinforcement but from the view of Tg, incorporation of Li_2O is not preferred and in the present invention, ***no Li_2O is included*** so that desired results can be obtained.

In the present invention, a seen from the results shown in Tables 1 and 2, the glass of amended claim 1 exhibits higher Tg because of lack of Li_2O.

In Hashimoto, there is no motivation of elimination of Li_2O from the glasses of Hashimoto since incorporation of Li_2O is preferred from the view of chemical reinforcement and it is taught that "Li.sup. + ion and Na.sup. + ion which are necessary for the chemical strengthening" (Col. 9, lines 34-35) .

Hayashi

Hayashi teaches glass substrate for magnetic disks not containing Li_2O. However, the glass composition is expressed in weight % in Hayashi and the glass composition of Table 1 of Hayashi converted into mol% is shown below. The values in ***bold italic*** are those beyond the scope of amended claim 1 now pending in this application.

mol%

	1	2	3	4	5
SiO2	66.74	65.98	***70.74***	67.28	***71.53***
B203	0.00	0.00	0.00	0.00	0.00
A1203	4.75	5.15	5.29	4.17	***0.87***
Li20	0.00	0.00	0.00	0.00	000
Na20	4.69	3.41	6.53	5.72	***12 91***
K20	4.63	6.01	2.87	5.27	0.31
MgO	3.43	6.94	0.84	1.76	5.89
CaO	5.92	3.16	7.22	5.06	8.46
SrO	4.61	6.13	2.61	3.42	0.00
BaO	3.57	2.32	3.09	5.56	***0.00***
ZrO2	1.63	***0.89***	***0.82***	1.73	0.00
Fe203	0.04	0.00	0.00	0.02	0.04
	100.00	100.00	100.00	100.00	100.00

MgO+CaO+SrO+BaO	17.53	18.55	13.75	15.81	14.34
CaO/MgO+CaO+SrO+BaO	***0.34***	***0.17***	0.52	***0.32***	0.59

Also, the importance of the ratio of CaO/(MgO + CaO + SrO + BaO) is set forth in the specification at page 9, lines 12-26 of the present application as follows:

> *"The amount of alkali metal oxide incorporated is desirably kept below a prescribed amount to prevent a drop in the glass transition temperature. However, when the amount of alkali metal oxide incorporated is kept down, glass melt properties deteriorate or the coefficient of thermal expansion tends to drop below the optimal range for a substrate employed in an information recording medium. Accordingly, to prevent such a drop in melt properties and such a reduction in the coefficient of thermal expansion, an alkaline earth metal oxide is introduced in the present invention. Since CaO is an alkaline earth metal oxide of relatively low molecular weight, it affords the advantage of tending not to increase the specific gravity of the glass. Although MgO also has the effect of inhibiting an increase in specificity. it has a greater tendency to reduce the chemical reinforcement effect than CaO. Thus, the proportion of CaO in the alkaline earth metal oxide is desirably high. Specifically, the quantities of each of the above-stated components are desirably adjusted so that the ratio of CaO/(MOO++ CaO + SrO + BaO) is greater than or equal to 0.5, desirably greater than or equal to 0.55, and preferably greater than or equal to 0.6."*
>
> New Claims

In view of the foregoing limitations in the disclosure of Hayashi, Applicants have added new claims 25 and 26 defining the ratio of CaO/(MgO + CaO + SrO + BaO) being greater than or equal to 0.55 and the ratio of CaO/(MgO + CaO + SrO + BaO) being greater than or equal to 0.6.

Koch et al

The patent to Koch et al is directed to a composition of silico-sodo-calcic glasses and their applications, none of which includes use in a substrate for a magnetic recording disk.

Magnetic disks must operate at high speed and the distance between the disk surface and the recording/pickup head is small. When such disks use a glass substrate, a high Young's modulus is desired and the coefficient of thermal expansion must match that of the metal spindle (typically stainless steel) on which the disk is mounted so that when the apparatus heats up

during use, no adverse effect (wobble, head crash, or the like) will result. A further consideration is that the glass should have a higher glass transition temperature Tg so that it may maintain stability and withstand higher temperature treatments, such as sputtering for application of a magnetic layers.

None of these are considerations in Koch et al, as its compositions are not intended for use in a magnetic disk substrate. The use is for production of substrates for emissive screens or fire-resistant panes in a process that produces a ribbon of glass using a float glass technique. As taught at col. 6, lines 1-18, the introduction of various alkaline earth oxides is to raise the strain point, increase chemical resistance and resistivity, and maintain the devitrification of the glasses within acceptable limits.

Applicants respectfully submit that none of these teachings are relevant to the production of a glass for a substrate for a magnetic disk, at least because of the absence of any consideration for the relevant properties of magnetic disks, including Young's modulus and high Tg values.

Claims 6-10, 15 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashimoto et al taken with either Hayashi et al or Koch et al as applied to claims 1, 5, 11-14, 19-21 above, and further in view of Ikenishi et al (US 2003/0109370).

Ikenishi et al

The Examiner cites Ikenishi et al for a teaching that a glass may be heated to the levels claimed in claims 6, 7, 10 and 15, as optimized for enhancing the strength needed to function as reinforced substrate for magnetic recording media system requirements, citing Ikenishi et al [0073] and [0074]. Further, the Examiner cites Ikenishi et al with regard to bending strength ratio prior to chemical reinforcement and temperature treatment, as defined in claims 8, 9, 17, 18 and 22.

First, Applicants respectfully submit that Ikenishi et al does not remedy the deficiencies of Hashimoto and Hayashi (Koch et al being non analogous and not relevant to production of glass for substrates), because it does not teach the combination of compositions as now set forth in amended claim 1.

Second, the present application and Ikenishi et al share the same inventive entities. Thus, to the extent that Ikenishi et al is still relied upon, it can be overcome by a Rule 132 Declaration..

Third, the priority date for the present invention is October 29, 2002, shortly after the U.S. filing date of Ikenishi et al (May 29, 2002) and may be overcome by a Rule 131 Declaration.

Secondary Considerations

The Examiner asserts that "a reasonable case for inherence of characteristics for product being claimed has been established. The burden of proving unobviousness is shifted to applicants when inherency has been demonstrated (MPEP 2112)." The Examiner also admits that "Applicants have demonstrated unobviously superior results for strengthened recording disk of limited composition ranges, however there is no claim commensurate in scope with this showing."

However, Applicants respectfully submit that claim 1 as now amended does have limitations that are commensurate with the disclosed superior results, as demonstrated above.

Applicants respectfully submit that the invention as now claimed is patentable over the prior art cited by the Examiner and that claim 1, and all the claims dependent therefrom should be considered allowable.

New Claims

Claims 24-27 have been added as dependent claims from claim 1 and define additional features of the inventive glass composition as claimed.

Claim 24

Claim 24 specifies that the recited amount of BaO is operative to increase the coefficient of thermal expansion and wherein BaO has less effect on Young's modulus than each of CaO and MgO.

Claims 25 and 26

Claims 25 and 26 specify a ratio of CaO/(MgO +CaO+SrO+BaO) with respect to managing the glass transition temperature Tg in the novel glass composition of claim 1.

Claim 27

Claim 27 specifies the importance of the amount of SiO_2 to the preferred glass composition as disclosed at page 7 of the original specification (paragraph [0032] of the published specification.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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